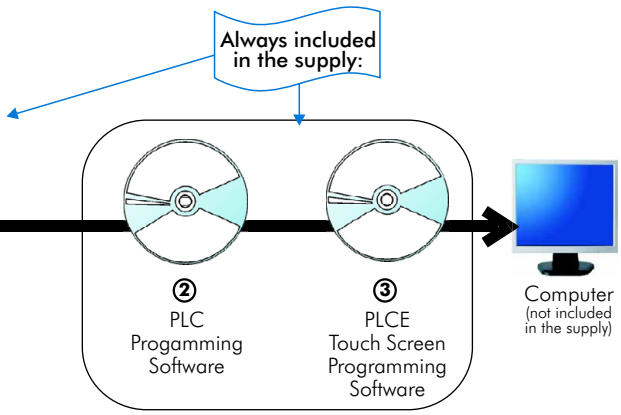
edibon

Technical Teaching Equipment

PLC Trainer

PLCE

① Unit: PLCE. PLC Trainer



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Products
Products range
Units
6.- Automation & Systems

PLC Process Emulators for working with PLCE

PLC Small Scale Real Applications for working with PLCE

ISO 9000: Quality Management
(for Design, Manufacturing, Commercialization and After-sales service)

European Union Certificate
(total safety)

Certificates ISO 14000 and
ECO-Management and Audit Scheme
(environmental management)

Worlddidac Quality Charter Certificate
(Worlddidac Member)

GENERAL DESCRIPTION

The **PLCE is a PLC trainer** designed by EDIBON. It allows the user to learn about logic programming without any background knowledge or experience.
The PLCE includes digital and analog inputs and outputs, switches, push buttons, potentiometers, etc., allocated in the front panel of the box.
This trainer is provided with a set of practices, through which the user will understand how a PLC works and how to program a PLC application to obtain a required functionality.

PLCE. PLC Trainer

The PLCE can also be used to work with the PLC Process Emulators and the PLC Small Scale Real Applications together:

- **PLC Process Emulators**:

They are units that emulate different process, systems, machines, etc, controlled by the PLCE.
The emulators include:
Metallic box.
Diagram or drawing of the simulated application.
Fuse protection.
D-SUB connector to communicate with PLCE.
LEDs and different displays as indicators.
Switches and push-buttons.
Potentiometers.
These process emulators are provided with switches, push buttons and LEDs to emulate common elements such as motors, detectors, sensors, pumps, valves, conveyors, etc.
Dimensions: 410 x 298 x 107 mm. approx. Weight: 2 Kg. approx.
These emulators offer us, among many others, several practical possibilities: industrial complex processes control, how to control machines with different controllable elements, control of electrical systems, control of hydraulic and electromechanic systems, using the analog inputs and outputs with the systems control, simulation of distributed control of processes, etc.
*Available PLC Process Emulators (see page 8 and next).

Example of Emulator:
PLCE-CST. Traffic Signal Control

PLCE. PLC Trainer

- **PLC Small Scale Real Applications**:

They are real applications of processes using small units, controlled by the PLCE. We can control process like liquid level, vibration, pressure, flow, proximity, deformation, temperature, etc.
These units are provided with real elements like Hall effect sensors, manometric pressure sensors, thermocouples, LVDT sensors, ultrasound sensors, air compressors, thermistors, encoders, etc.
* Available PLC Small Scale Real Applications (see page 25 and next).

Example of PLC Small Scale Real Application:
PLCE-BS6. Liquid Level Test Module

PLCE. PLC Trainer

Items supplied as standard

① PLCE. Unit:

Steel box.
Power supply 110-240Vac.
ON/OFF power switch.
Power supply connector.
5A Fuse for protection.
RS232 cable to communicate with PC.
SUB-D connector to communicate with the PLCE applications.
FP-X C30R Panasonic PLC unit. The key features are:
Ultra-high processing speed of 0.32 μs per instruction.
Large Program Capacity of 16 Kstep.
Independent Comment Memory.
Maximum number of I/O points is 300.
3 different I/O modules:
1) Digital I/O module:
Inputs: Number of inputs: 16. Voltage: 24Vdc.
Outputs: Number of outputs: 14. Output type: relay. Output capacity:2A.
8 On/off switches.
8 Push-buttons.
2) Analog I/O module:
Inputs: Number: 8. Input Range: 0 to +10V.
Outputs: Number: 4. Output Range: -10V to +10V. Resolution: 12bits.
6 Adjustable analog signals: Range: 0 to +10V.
3) Touch screen :
Display: STN monochrome LCD Display. Resolution: 128 (W) x 64 (H) dots. Display color: 2. LCD life: Average 50.000 hours.
Backlight: 3-color LED backlight (green, red, orange). Different Displayable fonts. Character types: Alphanumeric characters.
Graphics: Straight lines, continuous straight lines, squares, circles, ovals, arcs, elliptic arcs, fan shapes, elliptic fan shapes, beveled squares, bitmaps.
Number of screens: approx. 160 screens. Part functions: messages, lamps, switches, data, bar graphs, keyboard.
Contrast adjustment.

② PLC Programming Software:

Programming software developed according to the standard IEC 61131-3.
Compatible with Windows operating systems.
Five programming languages:
Ladder Diagram (LD). Structured Text (ST). Instructions List (IL). Sequential Function Chart (SFC). Function Block Diagram (FBD).
Remote programming, service, and diagnostics.
Minimum program size.
Powerful debugging and monitoring tools.
Supports user created functions and function blocks.
Saves project files inside the PLC.
Examples and Quick Start Tutorial included.

③ PLCE Touch Screen Programming Software:

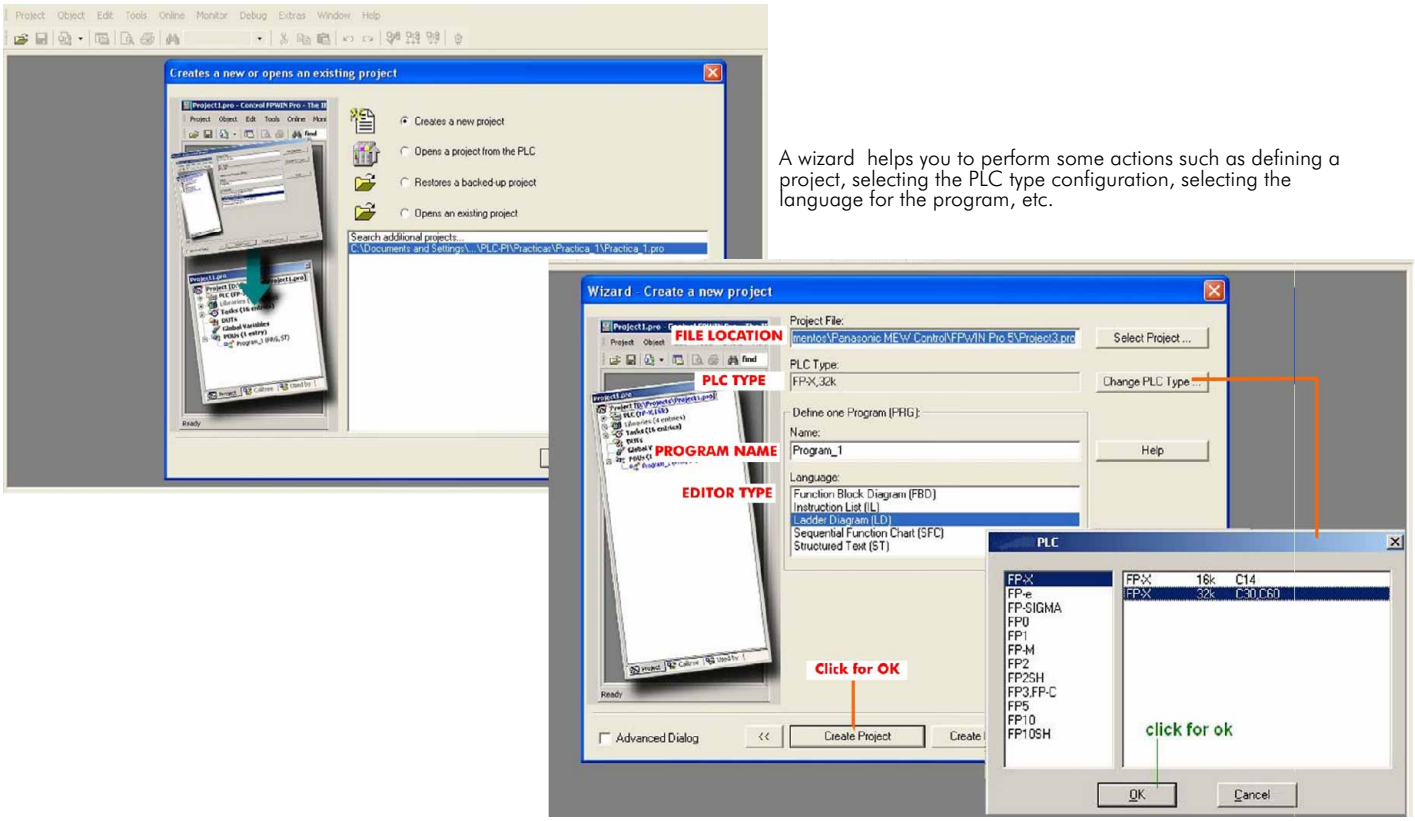
Tools for Screen Creation:
This Software is a tool designed for programming touch type screens. Thanks to this tool, suitable screens and images can be created and designed. It allows to transfer the program to the screen, load projects done from the terminal and print screens created.
Plenty of functions. Screens Creation:
This Software has plenty of programming tools. Devices for visualizing texts, diagrams or data; drawing a button, graph, pilots. This Software allows to create functional screens adaptable to each application.
Drawing Functions: It can be done different programming elements through suitable icons and bitmaps.
Easy Operativity (Click and slip):
A library of elements allows to program through the mouse, simply slipping an element and locating it in its place. (Click and Slip).
Easy creation of user libraries:
User libraries can be registered and storaged with suitable elements to be used in next projects.
Printing. The different screens of the project can be printed:
It is possible to visualize a preliminary view. It is also possible to select the screens or configurations to be printed.
Easy use. Bitmaps Editor:
There is a tool that allows to create, read and modify bitmaps in order to use them as screen programming elements. Suitable buttons created from images can be easily made.

④ Cables and Accessories, for normal operation.

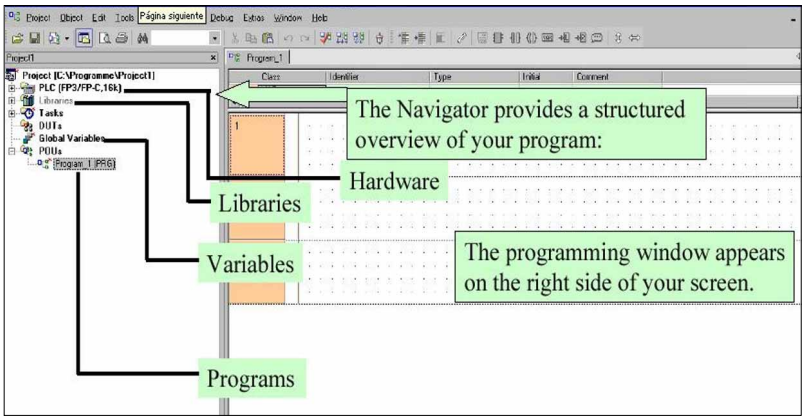
⑤ Manuals: This unit is **supplied with several manuals:** Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration, Practices Manuals, PLC Programming Software & PLC Touch Screen Programming Software Manuals.

PROGRAMMING SOFTWARE

Some Typical Screens

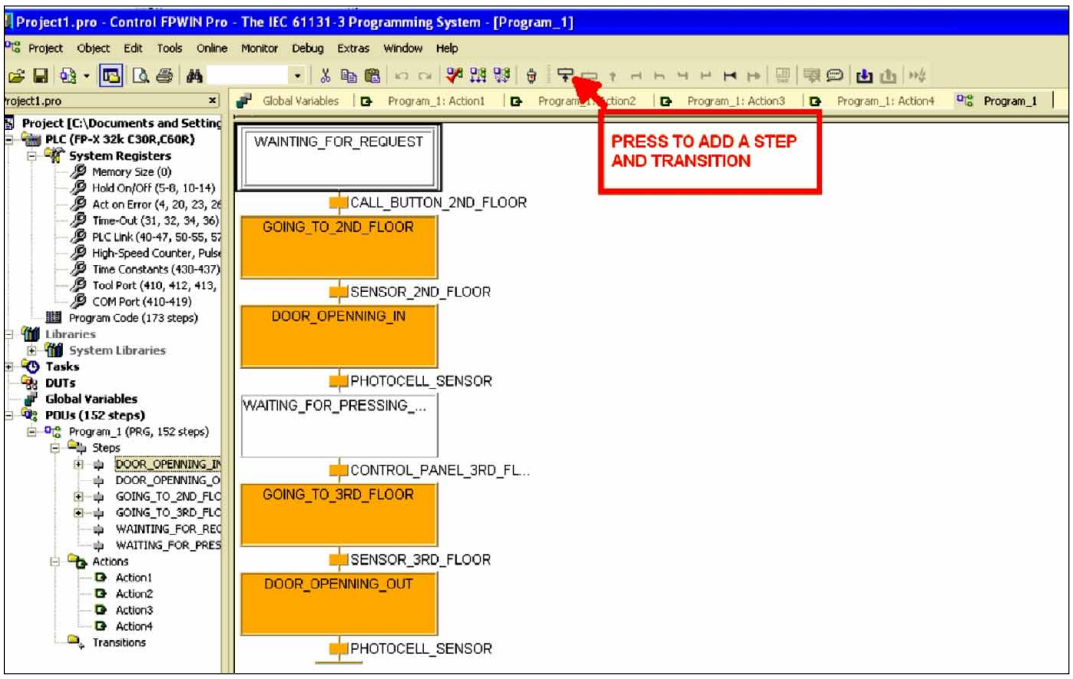


A wizard helps you to perform some actions such as defining a project, selecting the PLC type configuration, selecting the language for the program, etc.



The graphical user interface of PLCE programming software provides a clear graphic representation for very complex projects where all components can be easily identified: hardware settings, libraries, variables, programming window.

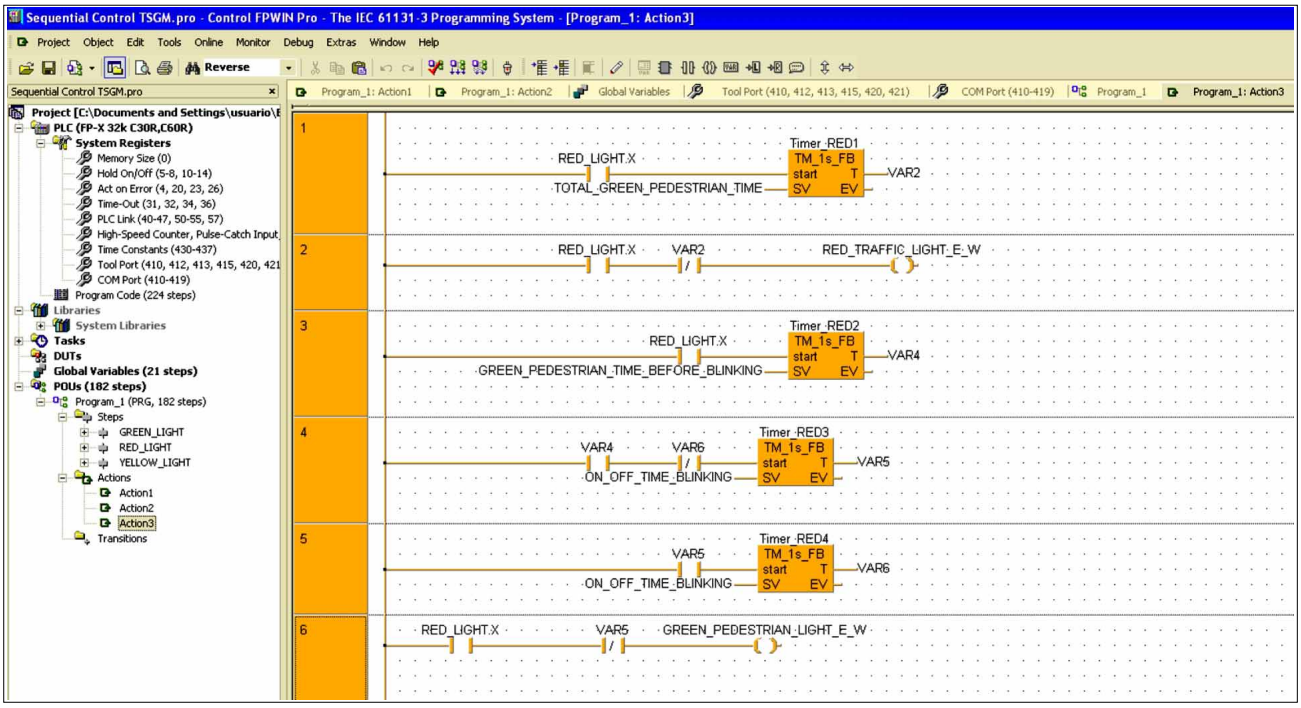
Example I:
Program to control an elevator system (PLCE-CA Emulator) using Sequential Function Chart (SFC) language.



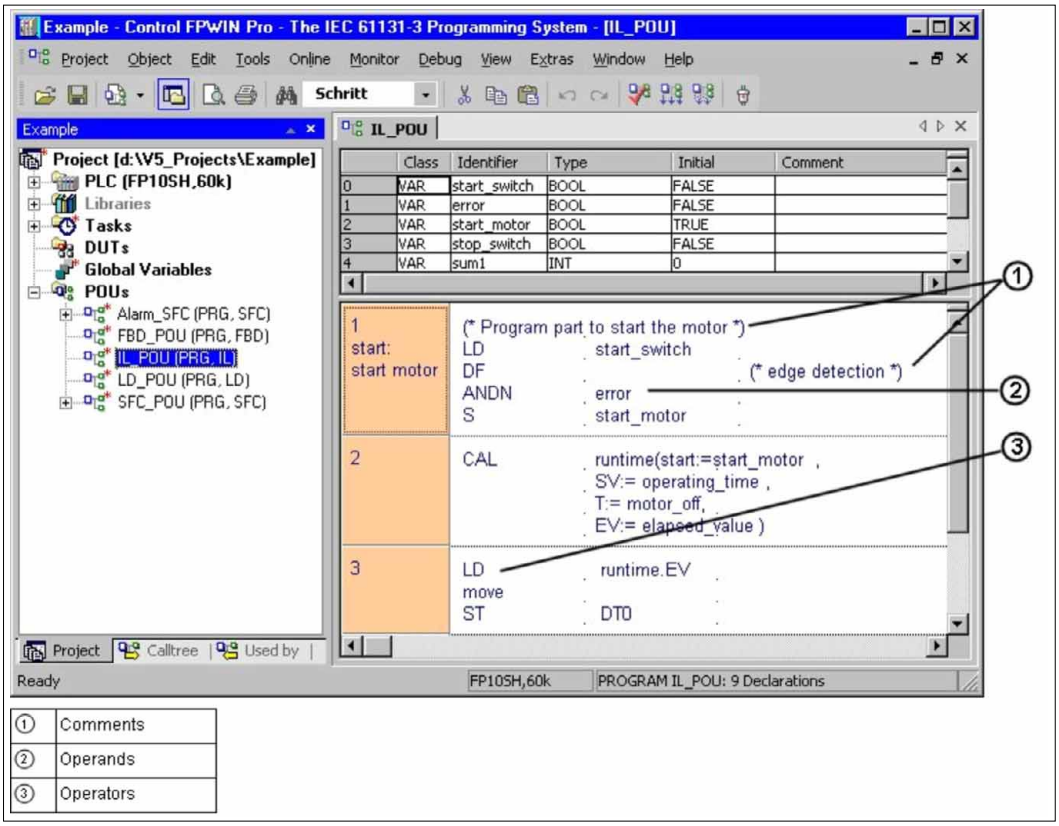
Continue...

Some Typical Screens (continuation)

Example II: Program to control an traffic light system (PLCE-CST Emulator) using Ladder Diagram (LD) language.



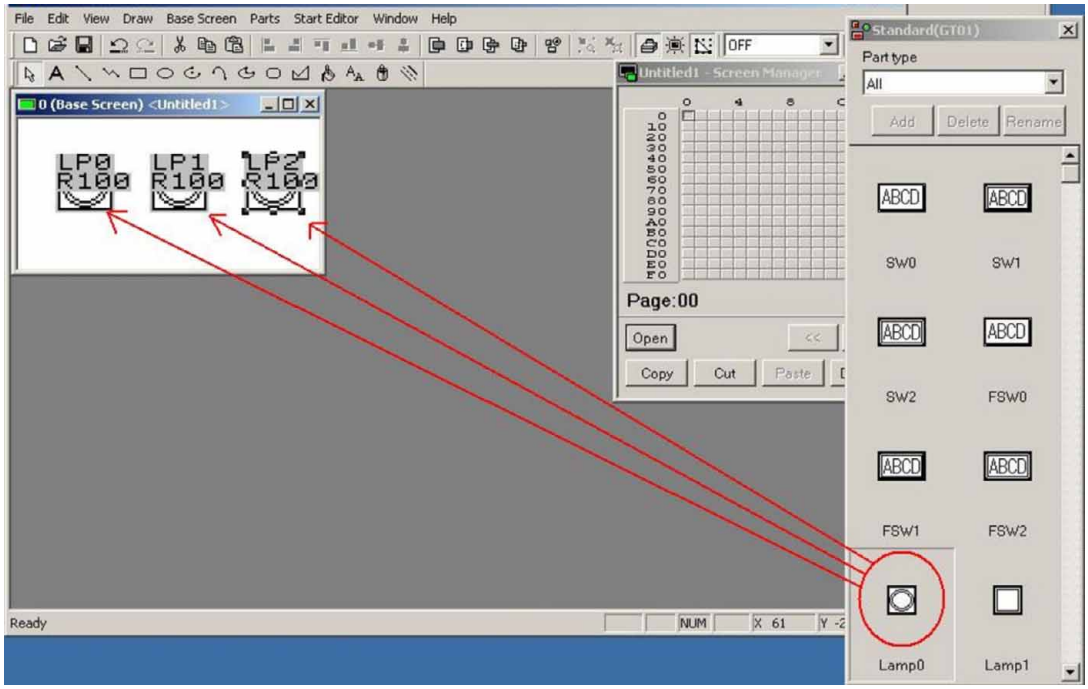
Example III:
Instruction List (IL) program.




```
IF Send THEN
   (* Copy characters of the variable SendString to the SendBuffer[1] *)
   (* SendBuffer[0] will be used by F144_TRNS. The number of bytes not
   yet transmitted is stored in SendBuffer[0] at each transmission *)
   F10_BKMV( s1_Start:= Adr_Of_VarOffs( SendString, StringHeaderSize),
             s2_End:= AdrLast_Of_Var( SendString), d_Start:= SendBuffer[1]);
   (* Send the information of the SendBuffer *)
   F144_TRNS( s_Start:= SendBuffer[0], n_Control:= LEN(SendString));
END_IF;
```

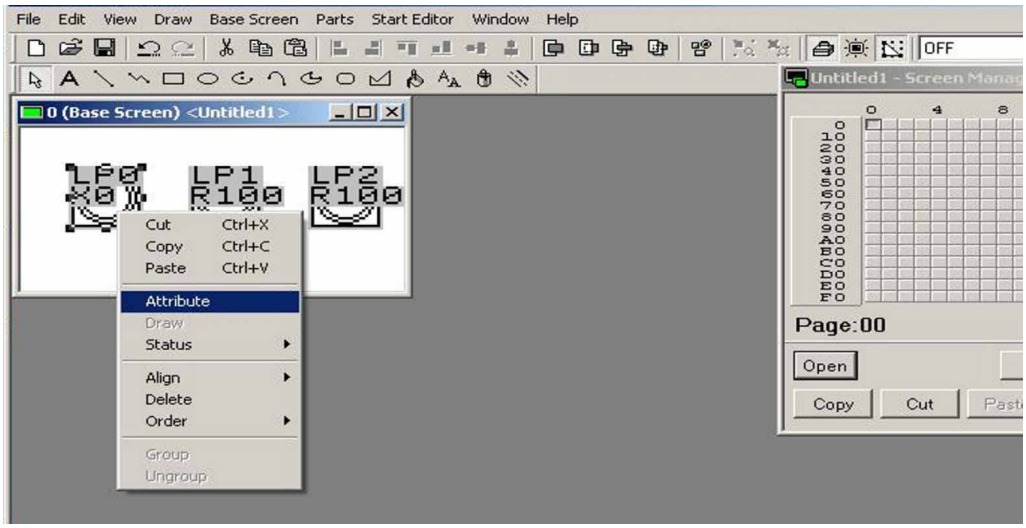
Example IV:
Structured Text (ST) program.

Some Typical Screens



The Touch Screen programming software tool allows to easily create custom screens for PLCE programs. Also some elements can be included by dragging and dropping from libraries.

Example V:
Creating a screen that will be used as a indicator screen for an industrial process.



EXERCISES AND PRACTICAL POSSIBILITIES

Some Practical Possibilities:

Using the PLC Programing Software:

1.-Understanding how to create different PLC applications and downloading to PLCE.

2.-Developing fundamental programs in different languages:
- Ladder Diagram (LD).
- Structured Text (ST).
- Instructions list (IL).
- Sequential Functional Chart (SFC).
- Functional Block Diagram (FBD).

3.-Studying number systems and data types:
- Decimal, Binary, Octal, Hexadecimal Systems.
- Bool, Integer, Word, Double, etc.

4.-Studying the fundamentals of logic:
- AND, OR, and NOT Functions and Bool Algebra.
- Developing Circuits from Boolean Expressions.
- Producing the Boolean Equation from a Given Circuit.
- Hardwired Logic versus Programmed Logic.
- Programming Word-Level Logic Instructions.

5.-Creating basic applications to test the digital I/O modules:
- Using switches and push-buttons as digital inputs.
- Using LEDs as outputs indicator.

6.-Creating basic applications to test the analog I/O modules:
- Using the analog input to read real analog signals.
- Using the analog outputs to generate analog signals and waveforms.

7.-Understanding how timers work and how to use them to control time-based processes:
- On-Delay timer instructions and function blocks.
- Off-Delay timer instructions and function blocks.
- Cascading Timers.

8.-Understanding how counters work and how counting is carried out:
- Up-Counter.
- Down-Counter.
- Cascading Counters.

9.-Data Manipulation Instructions:
- Data Manipulation.
- Memorize data.
- Data Transfer Operations.
- Data Compare Instructions.

10.-Understanding program control instructions:
- Jump and Conditional Instructions and Subroutines.
- Sequential control.

11.-Using math and arithmetic instructions:
- Addition.
- Subtraction.
- Multiplication.
- Division.
- Additional instructions.

12.-Functions Blocks and libraries.

13.-Complex control systems. PID function.

*Some applications related to these practices are included in the supply.

Using the PLCE Touch Screen Programming Software:

14.-How to create a simple application for the PLCE screen.

15.-How to commute digital outputs of the PLC through the screen.

16.-How to commute several digital outputs simultaneously. (Working with words).

17.-Writing on and reading from a data register.

18.-How to write a data register in a range of values.

19.-Switching from one screen to another.

*Some applications related to these practices are included in the supply.

Specific Applications with the PLC Process Emulators.

Specific Applications with the PLC Small Scale Real Applications.

Other practical possibilities:

- It is possible to make simulations without need of any external element, causing analog inputs and/or digital ones, and to observe what happens in the outputs.
- It is also possible to introduce real analog inputs (for example: the transducer value in volts of a temperature sensor) and/or digital inputs (for example: an external pulser) and to connect real actuators in the output, (for example: a pump).

REQUIRED SERVICES

- Electrical supply: single-phase, 220V. 50Hz or 110V. 60Hz.
- Computer (PC), with a serial port free.

DIMENSIONS & WEIGHTS

PLCE Unit: -Dimensions: 490 x 330 x 310 mm. approx.
-Weight: 20 Kg. approx.

➤Traffic and Parking

PLCE-CST. **Traffic Signal Control**

It represents an automatic traffic signal control where is possible to emulate a traffic crossroads.
We can select the operation mode choosing between day or night and to control the traffic state using traffic lights and vehicle detectors.
The pedestrians can request to stop the vehicles flow pushing a button.

PLCE-AV. **Car Parking**

It represents a car parking where is possible to emulate the elements used in a typical car parking like barriers, vehicles presence detectors, traffic lights, fire sensors.
We can know the number of vehicles inside the parking with lights and if the parking is full or free.

PLCE-AG2Z. **Two Zones Parking Garage**

It represents a parking garage with two zones where is possible to emulate the control of four barriers, two in the entrances an two in the exits, in the automatic parking.
We can know the number of vehicles inside the parking with lights and if the parking is full or free.

➤Small Industrial Machines

PLCE-CA. **Elevator Control**

It represents an elevator control allowing to emulate the sequence of actions of an elevator in a three floors building.

The elevator's state using different sensors and lights can be demonstrated.

It is included elements like alarms, lights and calling buttons in the emulation, etc.

The sequence of actions in the elevator's control panel can be seen too.

PLCE-CLA. **Automatic Washing Machine Control**

It represents an automatic washing machine control allowing to emulate the sequence of actions carried out by a washing machine.

We can start/stop the system, to use the three program selector, the temperature control and to know the machine's state using different sensors and lights which indicates us the machine's actions and its state.

PLCE-MB. **Drinks Machine**

It represents an automatic drinks machine where we have the possibility of work with a complete scheme of actions of an automatic drinks machine.

We can select a drink, to insert coins, to obtain drinks, the coins can be returned pushing a button and is possible to simulate the fault of drinks in different columns.

PLCE-MBC. **Hot Drinks Machine**

It represents an automatic hot drinks machine where we have the possibility of work with a complete scheme of actions of an automatic hot drinks machine.

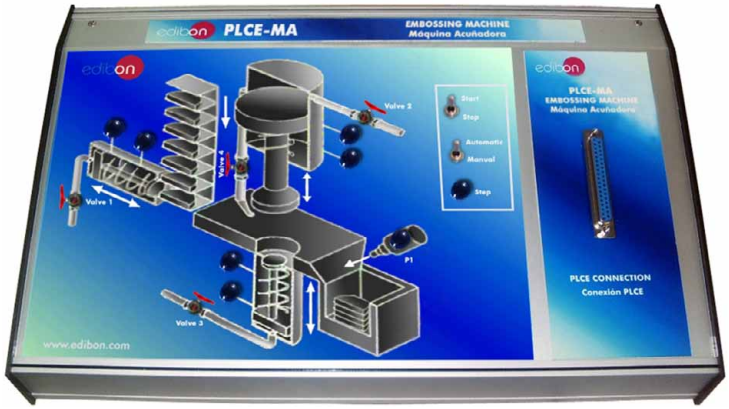
We can select a drink, we can know the level of drink using sensors and the status of the machine.

Finally we can select sugar and extra-milk.

PLCE-CB. **Pump Control**

It represents a pump control where we have four pumps inserting water in a big tank.
We can regulate the number of pumps working and to know the level of water into the tank using level sensors.
Is possible to regulate the discharge rate with the output valve in the tank.

PLCE-MA. **Embossing Machine**



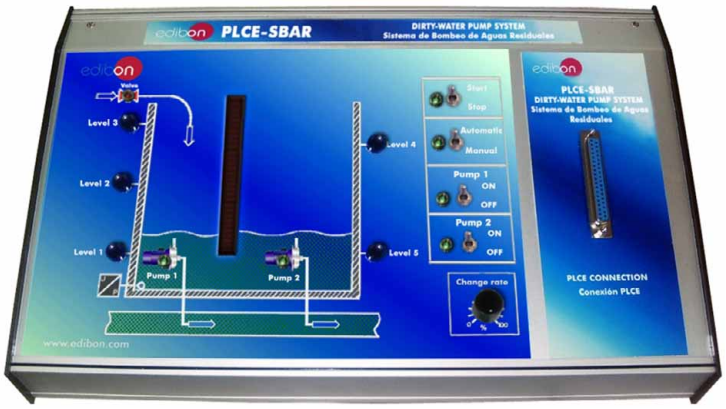
It represents the embossing process of metal disks controlled with an electropneumatic system.
The valves regulate the flow of gas to the electropneumatic system moving the steel punches and we can know the position of the steel punches using position sensors.

➤Small Industrial Systems

PLCE-ST. **Drilling System**

It represents a drilling system where we can emulate the movements of a drill.
We have two motors one for vertical movements and the other one is the motor of the drill.
We can switch on/off the coolant valve and to select the clamping pressure.

PLCE-SBAR. **Dirty-Water Pump System**

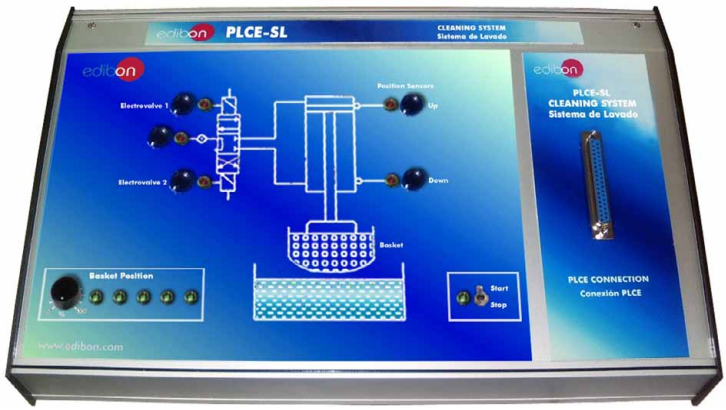


It represents a dirty-water pump system where we can emulate the control of the dirty-water flow using a valve and two pumps which insert dirty-water in the pipe from the dirty-water tank.
The level of dirty-water into the tank is measured using four level sensors.

PLCE-SBP. **Pump System (Pressure)**

It represents a pressure system where we use two pumps with their motors when we have to introduce air in the tank.
We can activate or deactivate the pumps with the three-phase contactors.
In the tank we have two level sensors and a pressure sensor.
The output of the pressured air is controlled using a flow sensor.

PLCE-SL. **Cleaning System**

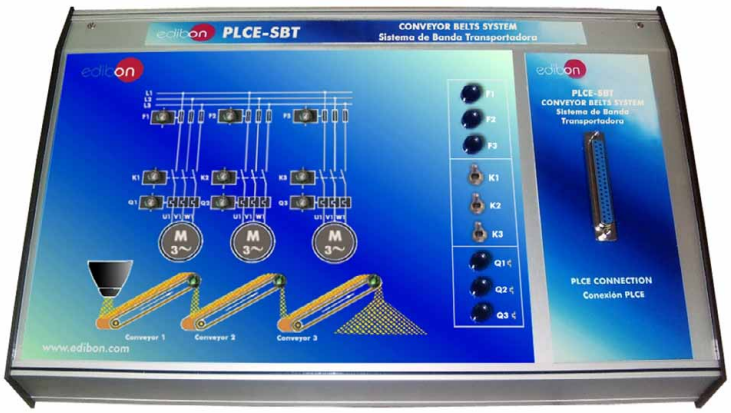


It represents a cleaning system where is possible to emulate the movement of a basket which has vertical movements.
The electrovalve has three positions and it can move the basket from its position to the designated position with a manual regulator.
We can know the position of the basket using position sensors.

PLCE-SALL. **Automatic Filling System**

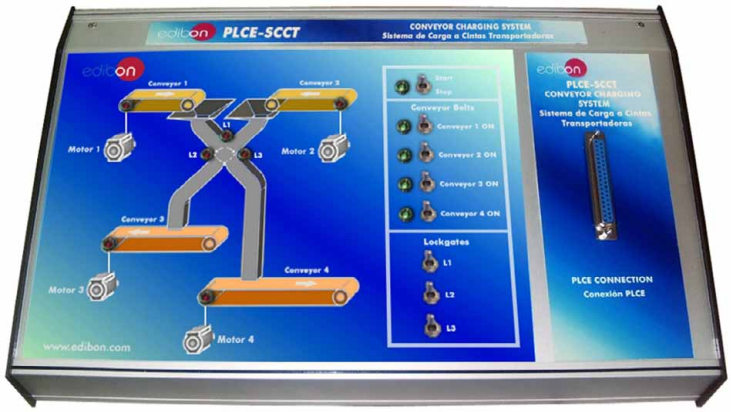
It represents an automatic filling system where we can choose the number of elements packed in each pack.
We can emulate the motors and the presence sensor of the system working.
We can emulate the movement of the conveyor belt with the packs in this filling process.

PLCE-SBT. **Conveyor Belts System**



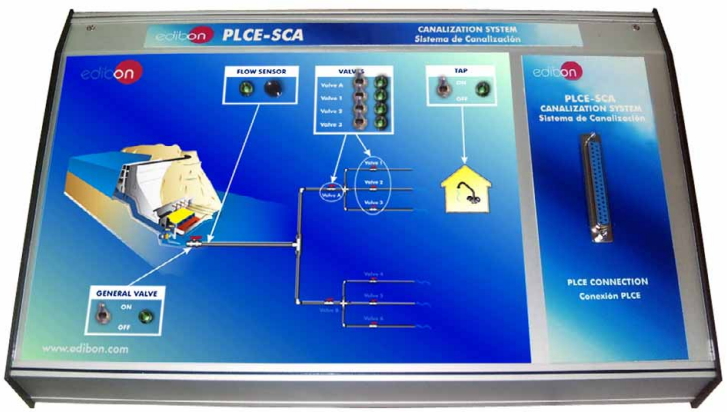
It represents a conveyor belts system where is possible to emulate a system of sand transport.
We can activate or deactivate the three motors using the three-phase contactors.
We have the possibility of simulate faults in the three-phase fuses and the three-phase magnetothermics.

PLCE-SCCT. **Conveyor Charging System**



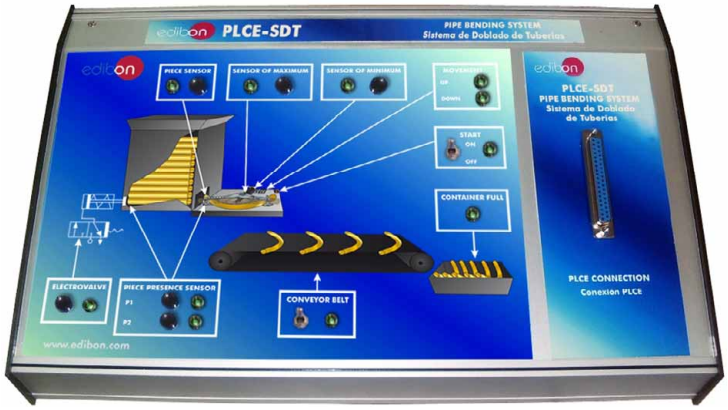
It represents a conveyor charging system where is possible to emulate the work of four conveyor belts switching on/off their motors and we can open or close three lock gates.
With this system we can control the conveyor charge process.

PLCE-SCA. **Canalization System**



It represents a channeling system where we have a dam which provides water using a general pipe with a general valve.
This general pipe provides water to other pipes, those pipes provides water to the houses, parks, etc using their own little valves.
In the homes the valves which regulate the water flow are taps.

PLCE-SDT. **Pipe Bending System**

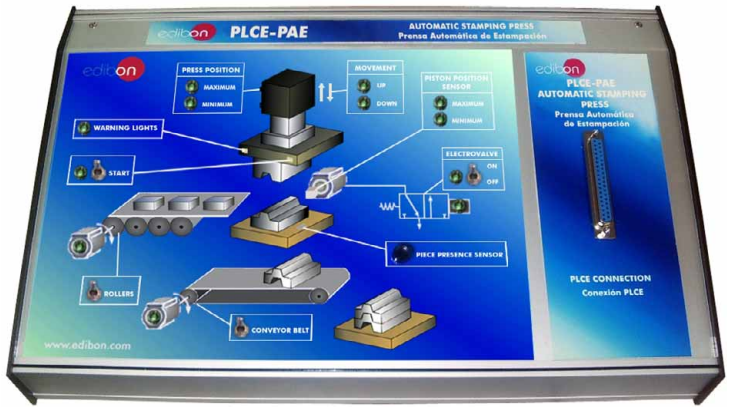


It represents a pipe bending system where we can emulate the bending process of the pipe.

We can start/stop the system using a switch and to know the state of the machine with maximum/minimum sensors, to insert pipes with an electrovalve and to control the conveyor belt.

We will know if we have a pipe in the machine with the piece presence sensor.

PLCE-PAE. **Automatic Stamping Press**



It represents an automatic stamping press where is possible to emulate the pressing process of steel sheets.

We can know the state of the press and electrovalve with the maximum/minimum sensors.

The press has a piece presence sensor, and warning lights.

We can control the rollers and the conveyor belt with switches.

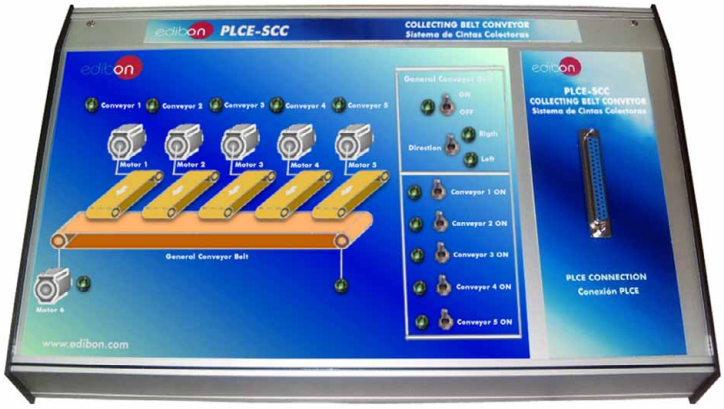
➤Big Industrial Systems

PLCE-PLLT. **Filling Process of Tanks**

It represents a filling process of tanks with three tanks where we can emulate the filling and emptying processes of the tanks and the level of the liquid inside the tanks.

Is possible to switch on or switch off the different input or output valves of each tank.

PLCE-SCC. **Collecting Belt Conveyor**



It represents a collecting belt conveyor system where is possible to emulate five conveyor belts transporting different materials to the general conveyor belt.

We can activate or deactivate the five conveyor belt motors and switch on/off the general conveyor belt in two directions left and right.

PLCE-MCC. **Mails Allocation Machine**

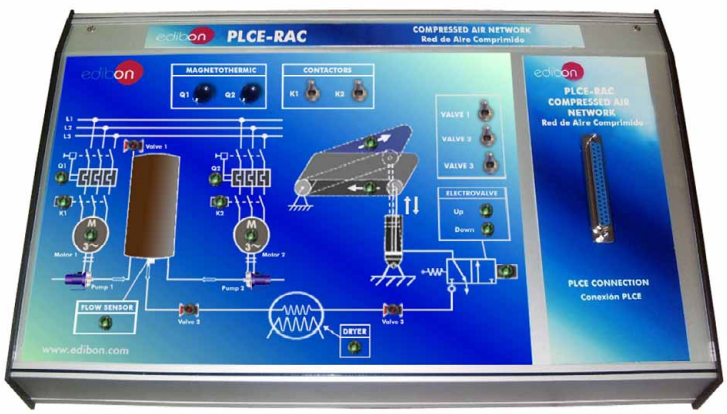
It represents a mails allocation machine which allocate the mails to different cities.

It uses five motors, one for each city and a conveyor belt.

We can activate or deactivate each motor and the general conveyor belt.

The general system can be activated or deactivated.

PLCE-RAC. **Compressed Air Network**

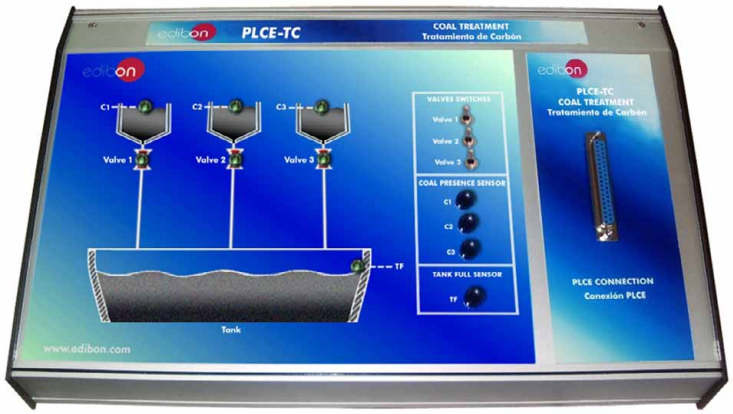


It represents a compressed air network where is possible to emulate the actions in an air network.

We can control valves, dryer, motors with contactors and we can know the flow in the output of the compressor with a sensor.

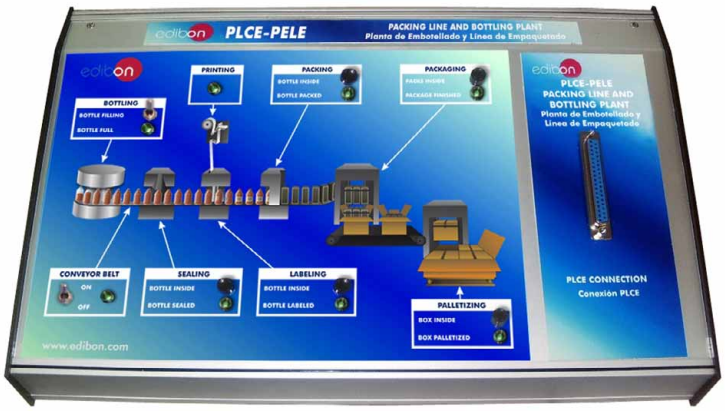
The electrovalve moves the final piston.

PLCE-TC. **Coal Treatment**



It represents a coal treatment system where we can see three chutes with three valves each one and a big tank.
We can control the flow of coal with the three valves and is possible to know if the tank or the chutes are full using coal presence sensors.

PLCE-PELE. **Packing Line and Bottling Plant**



It represents an automatic packing line and bottling machine where is possible to emulate the processes of bottling, sealing, labeling, packing and palletizing.
In this automatic plant we can control the movement of the conveyor belt and to obtain information about the process using sensors.

➤Simple Control Applications

PLCE-CA2P. **Two-Doors Access Control**

It represents two automatic doors where is possible to emulate the movements and positions of each automatic door using sensors and electrical motors.
We have the option of activate or deactivate the electrical motors.
The doors can be opened using the presence sensors.

PLCE-CI. **Fire Control**

It represents a fire control station where is possible to emulate different emergency situations with fire.
We have the possibility of activate and deactivate the alarm buttons, the fire detectors, the uninterruptible power supply, the elevator, the emergency door, the exit signs, and the temperature sensors.
We can also activate the water pump.

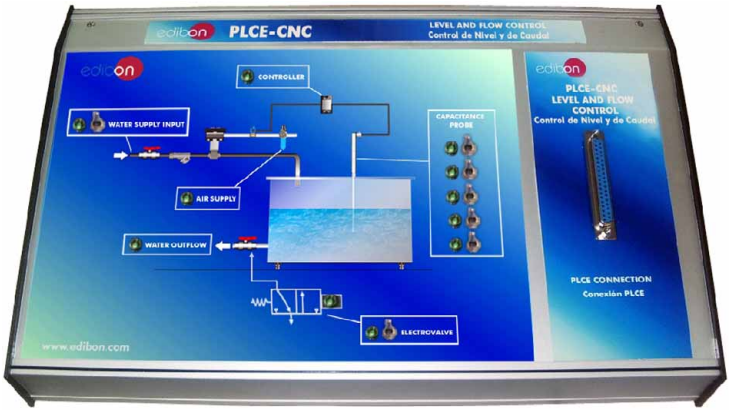
PLCE-CP. **Proximity Control** (security)

It represents a proximity and presence security control where we can obtain information about the presence in different places of a bank office using a PIR sensor, presence sensor, magnetic sensor and infrared electronic barriers.
The office has an alarm and a bell.
We can also activate a security camera and the security key.

PLCE-CCO. **Sluice Gate Control**

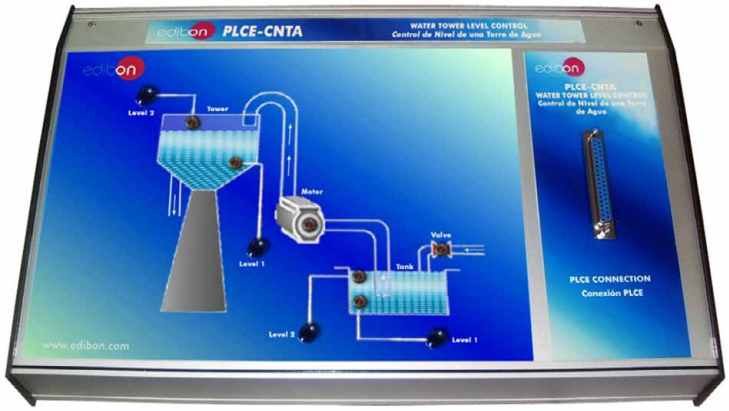
It represents a sluice gate control where we can see three sluice gates and we have to control them using the water pumps and the gates control.
We can start/stop the system using the general switch and we have the possibility of faults using the fuses and the magnetothermics.

PLCE-CNC. **Level and Flow Control**



It represents a level and flow control where we can fill the tank with water.
We can control the water supply and the water outflow with an electrovalve.
We know the state of the tank with a capacitance probe which shows the level of water in the tank with lights.

PLCE-CNTA. **Water Tower Level Control**

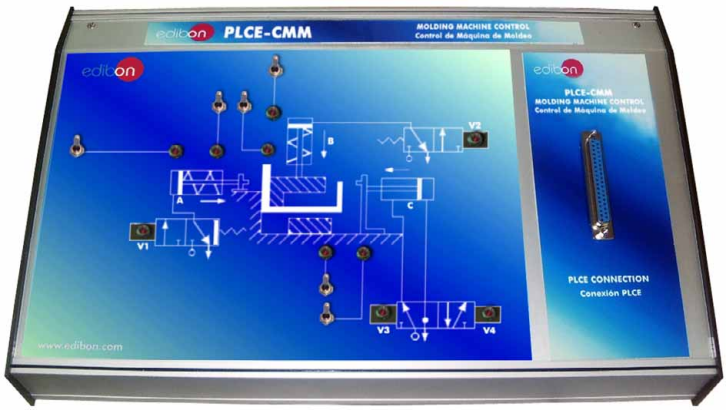


It represents a water tower level control where is possible to emulate the water flow control with the input valve and the motor of the pump.
We can measure the level of water in the tank and in the water tower using sensors.

PLCE-CF. **Photo Control**

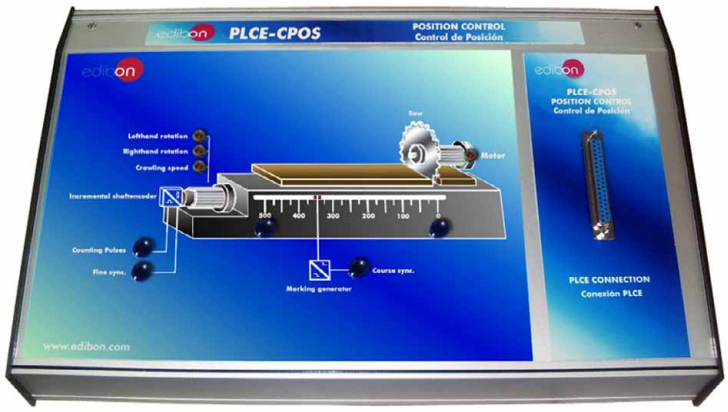
It represents a photo control machine where is possible to emulate the functions of the camera, dryer, flash and printer.
We have a photo presence sensor, a coin presence sensor and the return coins possibility.
Finally we can switch on/off the machine.

PLCE-CMM. **Molding Machine Control**



It represents a molding machine control where we can emulate a machine which gives shape to the pieces pushing them.
It works with three electrovalves which we can activate or deactivate, each electrovalve has a limit switch.

PLCE-CPOS. **Position Control**



It represents a position control where we can move the sheet to the correct position using a motor with a lefthand and righthand rotation and crowling speed the incremental shaft encoder can count pulses and to give a fine sincronism.

We have the possibility of saw the sheet connecting the saw motor.

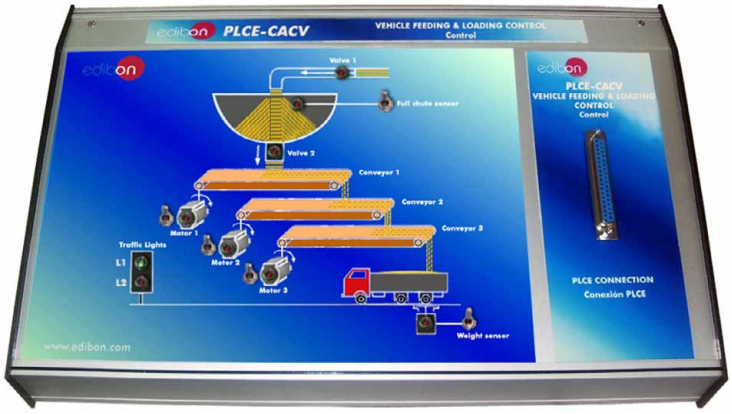
PLCE-CS. **Silo Control**

It represents a silo control system where we can emulate the filling process.

The filling motor has a manual rate or an automatic rate and the output valve has its own discharge rate.

We can measure the level with four presence sensors and to know if the silo is full with the full sensor.

PLCE-CACV. **Vehicle Feeding & Loading Control**



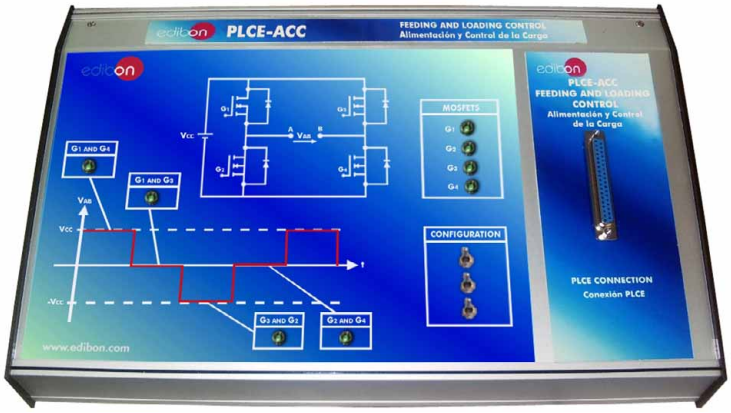
It represents a vehicle feeding control where we use three conveyor belts to transport the material to the vehicles.

We can switch on/off each conveyor belt and the valves.

We have two traffic lights which can indicate when the vehicle can start its movement and a weight vehicle sensor.

➤Industrial Control Applications

PLCE-ACC. **Feeding and Loading Control**

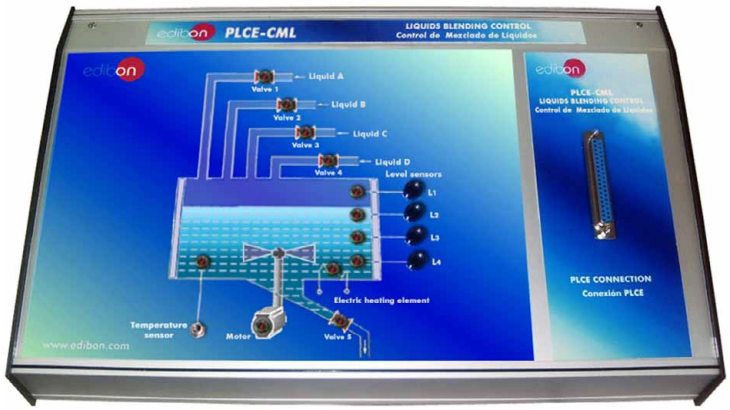


It represents a feeding and loading control system where we can control the voltage in the load between the A-B terminals.

We have to select a configuration which activate or deactivate the mosfets and we can know what switch is closed with its own light.

We can see in the graph the state of the voltage in the load between the A-B terminals.

PLCE-CML. **Liquids Blending Control**



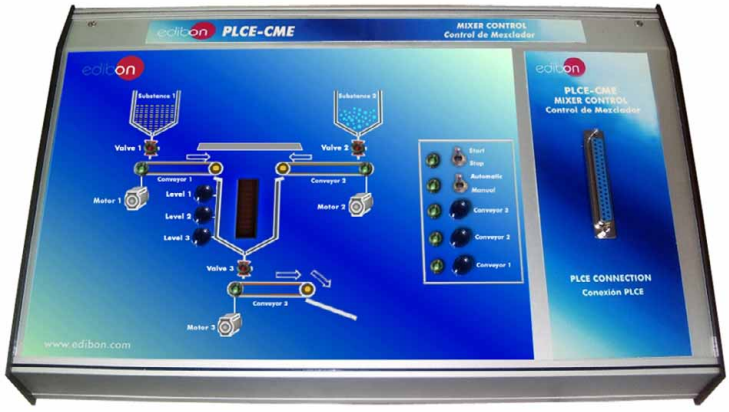
It represents a liquids blending control where is possible to emulate the mix of different liquids and their flows are regulated using four valves.

The liquids are mixed using a mixer with its own motor.

The flow of the mix is regulated using an output valve.

We can measure the temperature and the level of liquid with sensors.

PLCE-CME. **Mixer Control**



It represents a mixer control where we can emulate the mix with two different products in a big chute from two little chutes using conveyor belts, finally the general conveyor belt will transport the mix.

We will control the motors of the conveyor belts and the valves in the system and we will know the big chute's level using sensors.

PLCE-CR. **Reactor Control**

It represents a reactor control where is possible to emulate the mix of a catalyst, an inert gas and the substance.

We can regulate the catalyst and the inert gas flow with valves, and the substance with a pump.

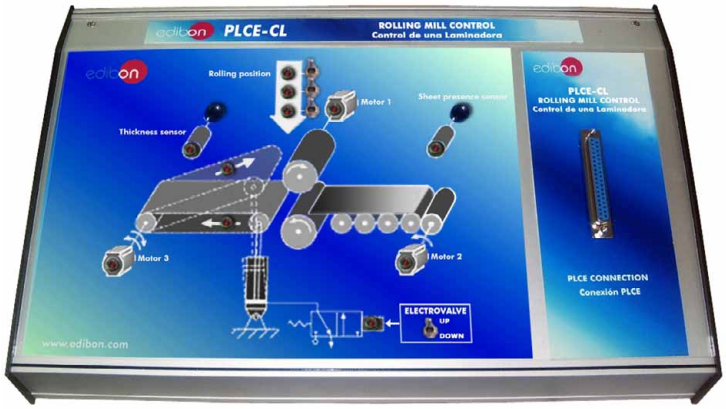
The inlet and the output of the product are regulated using valves.

We mix the substances with an agitator into the reactor.

PLCE-CCP. **Count and Position Control**

It represents a count and position control where is possible to emulate the robot's movement selecting the general final position.
It shows with lights the final selected position of each motor.
We can know when the robot is opening or closing its hand and when it has taken a piece with light signals.

PLCE-CL. **Rolling Mill Control**



It represents a rolling mill control where is possible to emulate the position of rolling mill, the movement of the different motors and the position of the conveyor belt using an electrovalve.
We can obtain information about the presence and the thickness of each sheet of metal using sensors.

PLCE-CTRA. **WorkCell Application**

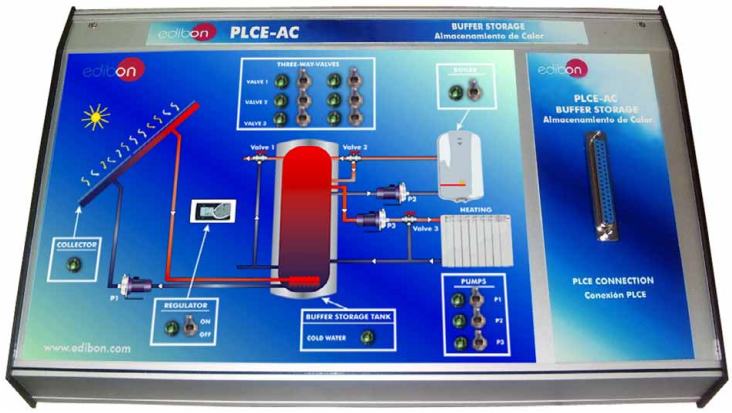
It represents a workcell with a robot inside where is possible to emulate the automatic work of a robot and the conveyor belts.
We can activate or deactivate the conveyor belts and start/stop the general system.
We have input and output sensors and a light which indicates when the robot is working.

PLCE-CTI. **Tower Lighting Control**

It represents a tower lighting control where is possible to emulate the lighting of different levels of a tower using a lights system.
It has two directions up and down and we can know the level using a display.

➤Thermal Applications

PLCE-AC. **Buffer Storage**



It represents a buffer storage system where is possible to emulate the storage of heat using fluids.

We can control the valves state, the pumps, the boiler, and the buffer storage tank state.

Is possible to know when the collector is working using a sensor.

PLCE-RT. **Temperature Regulation**

It represents a temperature regulation system where we can control the temperature inside our home.

We can regulate the temperature using the thermostat and the temperature sensor.

The heater and the solar cells will heat the water inside the water circuit and it will fill the radiator heating the house.

PLCE-CSC. **Heating System Control**

It represents a heating system control where is possible to emulate the heating process controlling the flow of hot water into the circuit activating or deactivating the valves in the pipes and using the temperature control regulator.

We can start/stop the system using a general switch.

PLCE-CSV. **Ventilation System Control**

It represents a ventilation system control where we are trying to clean the air in a garage.

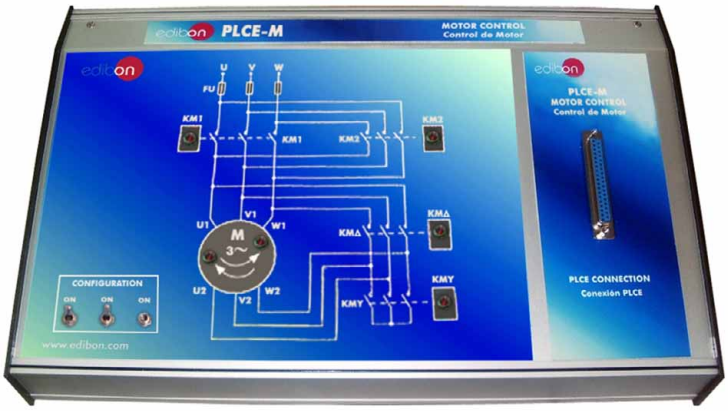
We can control the air inside measuring the level of CO and smoke with sensors.

We can activate four pumps and two fans.

Is possible to control the traffic lights and the automatic barriers.

➤Electrical Machines Control (Motors)

PLCE-M. **Motor Control**



It represents a motor control where is possible to emulate the movements of a three-phase motor with both turning directions controlled by three-phase contactors.

In the secondary, we can use the three-phase contactors with the star or delta connection.

PLCE-MPP. **Stepper Motor Control**

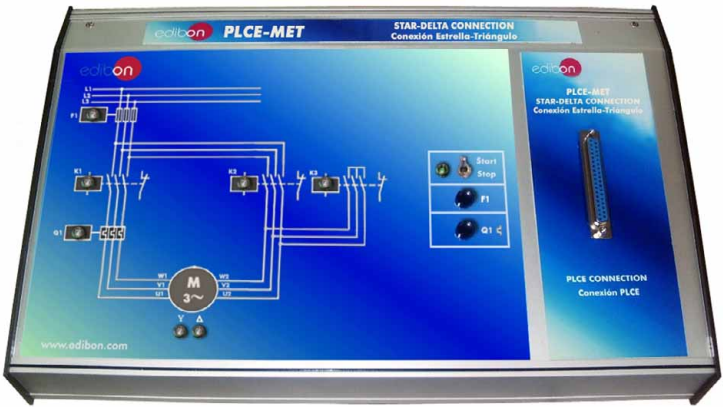
It represents a motor control where is possible to emulate the stepper motor.

We can start/stop the stepper motor using a switch.

It has reverse/forward directions controlled by a switch, and it can be controlled in manual or automatic mode.

The speed regulation is controlled using three switches and the position is controlled using an encoder.

PLCE-MET. **Star-Delta Connection**



It represents a star-delta connection in the secondary and emulates the motor's movement.

Is possible to switch on/off the motor and connect the secondary in star-delta connection using the three-phase contactors.

We can simulate faults with the three-phase fuses and the magnetothermics.

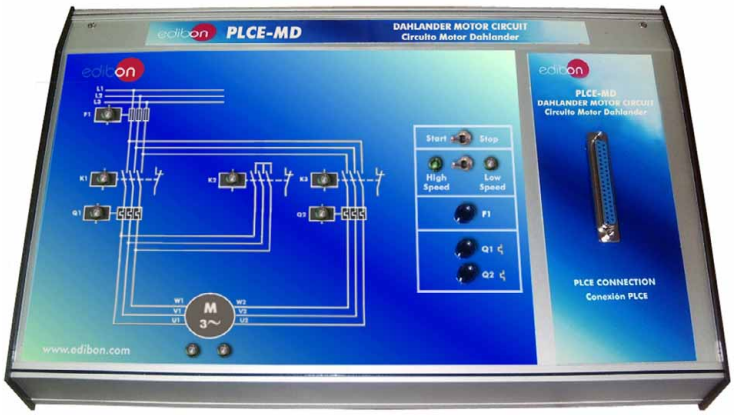
PLCE-MCETI. **Reversing Star-Delta Connection**

It represents a reversing motor with star-delta connection in the secondary and emulates the motor's movement.

Is possible to switch on/off the motor in both turning directions and connect the secondary in star-delta connection using the three-phase contactors.

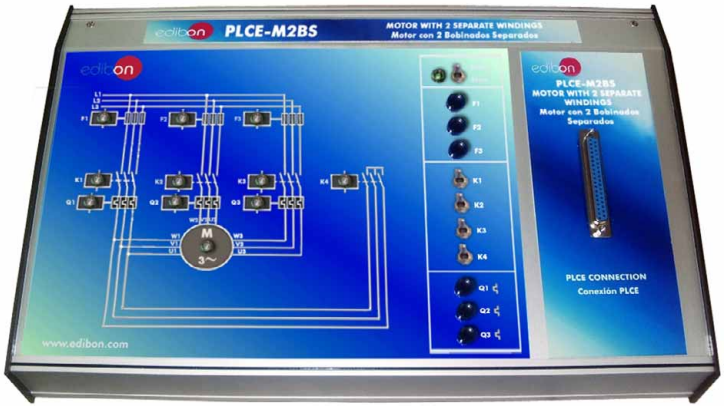
We can simulate faults with the three-phase fuses and the magnetothermics.

PLCE-MD. **Dahlander Motor Circuit**



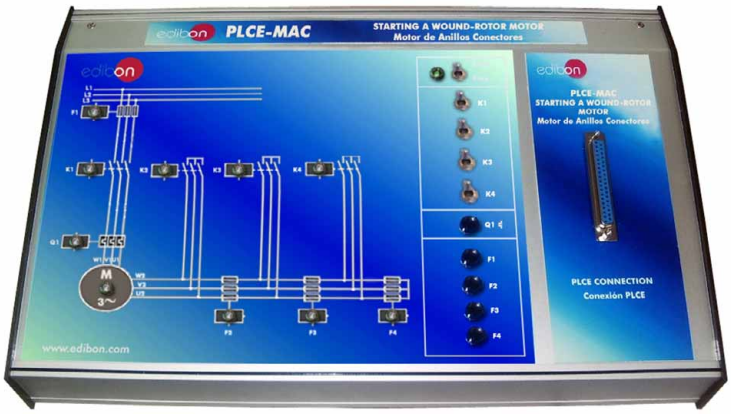
It represents a Dahlander motor which has two connections of velocity with 2 and 4 poles and emulates the motor's movement.
Is possible to switch on/off the motor in both turning directions and to connect it with 2 or 4 poles using the three-phase contactors.
We can simulate faults with the three-phase fuses and the magnetothermics.

PLCE-M2BS. **Motor with 2 Separate Windings**



It represents a motor with two separate windings and emulates the motor's movement.
Is possible to switch on/off the motor and to connect the different windings and the secondary with the three-phase contactors.
We can simulate faults with the three-phase fuses and the magnetothermics.

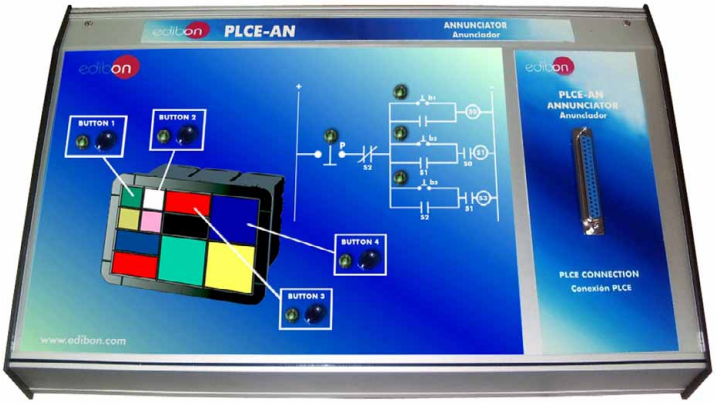
PLCE-MAC. **Starting a Wound-Rotor Motor**



It represents the starting of a wound-rotor motor where is possible to emulate the motor's movement.
Is possible to switch on/off the motor and to connect the secondary with different loads with the three-phase contactors.
We can simulate faults with the three-phase fuses and the magnetothermics.

➤Alarms/Current

PLCE-AN. **Annunciator**



It represents an annunciator where is possible to emulate the operation of one of this machines which shows what button is pushed lighting the button pushed.

We have an annunciator with several buttons and near of the annunciator we have an electrical scheme which shows what switch is activated or deactivated.

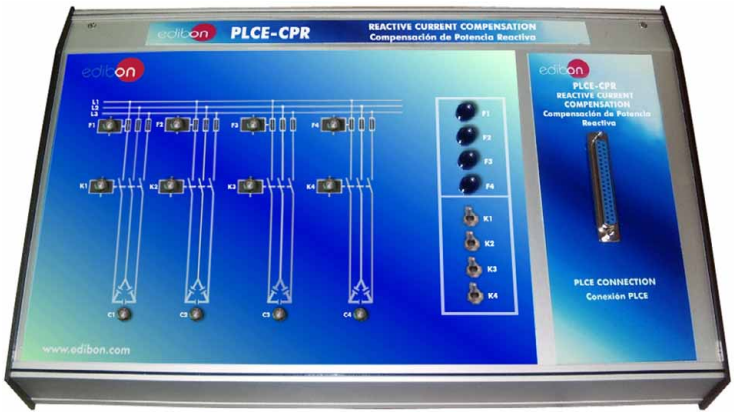
PLCE-SLU. **Running Lights**

It represents a running lights system where we can emulate the control of the eight lights in different speed, sequence and direction.

We can start/stop the system using a switch and we can do it in automatic or manual state.

We have three kinds of sequences and two directions and an speed control.

PLCE-CPR. **Reactive Current Compensation**



It represents a reactive current compensation system where is possible to emulate the connection of three-phase capacitive loads.

We can connect each load using the three-phase contactors.

We can simulate faults with the three-phase fuses.

PLCE-MCI. **Reversing Contactor**

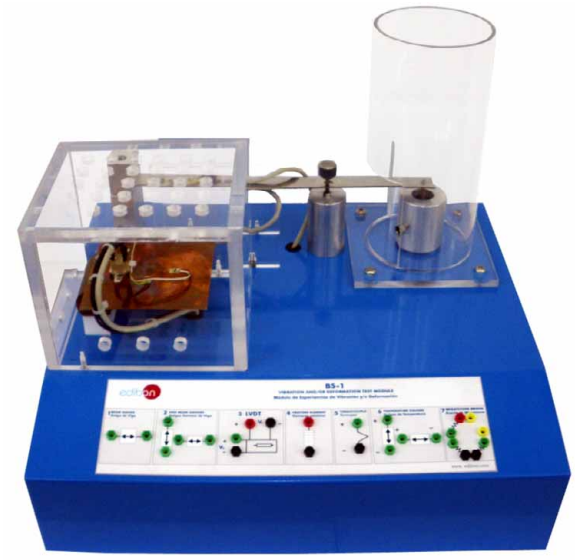
It represents a three-phase motor with reversing contactors and emulates the motor's movement.

Is possible to switch on/off the motor in both turning directions using the three-phase contactors.

We can simulate faults with the three-phase fuses and the magnetothermics.

➤Sensors

PLCE-BS1. **Vibration and/or Deformation Test Module**



Specifications:

Painted steel box.
Connection diagrams for each transducer are represented graphically.
Real industrial elements.
Extensiometric gauges:
- Gauges of a metallic material that vary their resistance depending on the distortion to which they are going to be subjected.
- They are stacked in different positions so that during the vibrant bar movement some of them suffer compressions and others extensions.
- Characteristics:
  - Resistance at 24°C: 120 Ω.
  - Gauge factor at 24°C: 2.120.

Heating resistance and thermocouple:
- Resistance used to produce temperature variations in the vibrant bar and to see how this situation affects the extensiometric gauges.
- A K thermocouple place near the resistance measures the bar temperature.
- Characteristics:
  - Temperature range: -50°C to 350°C.

LVDT Sensor:
- Linear displacement sensor, that detects the relative displacement of a ferromagnetic core between the primary and the secondary.
- Input Voltage range: 10 to 24VDC.

D-SUB to communicate with PLCE.
Connection pins.
Dimensions: 405 x 300 x 350 mm. approx. Weight: 10 Kg. approx.

PLCE-BS2. **Temperature Test Module**

Specifications:

Painted steel box.
Connection diagrams for each transducer are represented graphically.
Real industrial elements.
Bimetallic switch sensor:
- Bimetallic contact thermal switch.
- Opening temperature: 50°C.
- Closing temperature: 30°C.

Adjustable bimetallic thermostat, with heater resistor that allows minimizing the differential cycles and preventing overpeaks.
Temperature range: 0°C to 30°C.
Relay AC:
- It allows to turn on and off the heater light bulbs placed over the temperature sensors.
- Voltage and current (nominal): 250V-10A.
- 3 sockets.
- Switching voltage: 12 V.

Capillary thermostat:
- Temperature range: 0°C-90°C.
- Max. bulb temperature: 150°C.
- Socket current: 15A, 250V AC.

Thermocouples:
- 3 Cromel-Alumel thermocouples type K.
- One of them is placed near the capillary thermostat and the bimetallic sensor, another on the adjustable bimetallic thermostat and the third one inside the magnetic collection.
- Each one of them is used to measure the temperature that each one of the sensor are controlling.
- Temperature range: -50 °C to 250 °C.

D-SUB to communicate with PLCE.
Connection pins.
Dimensions: 405 x 280 x 335 mm. approx. Weight: 10 Kg. approx.

PLCE-BS3. **Pressure Test Module**

Specifications:

Painted steel box.

Connection diagrams for each transducer are represented graphically.

Real industrial elements.

Linear positioning sensor (Potentiometer):

- Resistor range: 500 Ω to 5KΩ.
- Operation force: 200-750g.

LVDT sensor:

- Sensibility: 780mV/mm.
- Power voltage: 10 to 24Vdc.
- Total path: 2.5mm.

Differential pressure sensor:

- Measurement range: 0 to 30 psi.
- Sensibility: 3.33mV/psi.
- Overpressure: 60 psi.
- Power supply range: 10 to 16 Vdc.

Extensiometric gauges:

- Nominal resistor @ 25°C: 120Ω.
- Gauge factor: 2.00 to 2.1 typical.
- Nominal resistor tolerance: ± 0.5%.

Manometric pressure sensor:

- Measurement range: 0 a 30 psi.
- Sensibility: 3.33mV/psi.
- Overpressure: 60 psi.
- Power supply range: 10 to 16 Vdc.

Absolute pressure sensor:

- Measurement range: 2 to 30 psi.
- Sensibility: -11mV/psi.
- Overpressure: 60 psi.
- Power supply range: 10 to 12 Vdc.

Air Compressor:

- Air flow: 10 l/min.
- Pressure: 1.83Kg/cm^2.
- Power supply: 220V, 50/60Hz.

D-SUB to communicate with PLCE.

Connection pins.

Dimensions: 400 x 270 x 320 mm. approx. Weight: 10 Kg. approx.

PLCE-BS4. **Flow Test Module**

Specifications:

Painted steel box.

Connection diagrams for each transducer are represented graphically.

Real industrial elements.

Flow optical sensor:

It gives an output in pulses proportional to the liquid flow. It is made up of a paddle wheel, placed on the fluid current that turns producing a pulse signal while passing between the emitter and the paddle detector.

Power supply: 4.5 to 24Vdc.

Standard flow range: 0.5 to 5 GPM.

High resolution optical flow sensor:

It works in the same way as the sensor just described with the difference that it is able to measure with a good resolution very low flow. At the output of this sensor we get a pulse signal with a frequency proportional to the flow volume that crosses the sensor.

Power supply: 5Vdc.

Measurement range: 0.25 to 6.5 l/min.

Temperature range: -40°C to 70°C.

Underwater pump:

The variation in the pump power supply voltage enables to change the water volume in the test module.

Level sensor by pressure:

It is a differential pressure sensor that measures the pressure practice by the water in relation to the atmospheric pressure, so the liquid level in the tank can be calculated.

Pressure range: 0 to 1 psi.

Output at scale bottom: 16.7mV.

Sensitivity: 16.7mV/psi.

Overpressure: 20psi.

Differential pressure sensor (Hole board system):

This sensor is connected to a hole-board system to measure the pressure difference caused by the volume narrowing of the conduct through which the water flows.

On this way, with the measurement of the pressure difference between the hole board water output and input, it is possible to calculate the water volume that crosses the board.

Measurement range: 0 to 30 psi.

Sensitivity: 3.33mV/psi.

Overpressure: 60 psi.

Changeable flow meter:

Using a small floating buoy that is inside the tube calibrated in liter/minute, it can be read the volume measure flowing through the pipe.

Range: 0-2 l/min.

V narrowing:

The connection between the main and the secondary tank, a dam, includes a "V" narrowing. The altitude of the water level above the dam bottom is a very precise measure of the flow relation. The ruler fixed on the right end of the tank will show this height. Main and secondary tanks.

D-SUB to communicate with PLCE.

Connection pins.

Dimensions: 405 x 280 x 400 mm. approx. Weight: 10 Kg. approx.

PLCE-BS5. **Ovens Test Module**

Specifications:

Painted steel box.

Connection diagrams for each transducer are represented graphically.

Real industrial elements.

Oven chamber.

Heating resistance:

Oven heating resistance made up of two parallel resistances with a maximum dissipation power of 500W.

The heating element power supply is of 0-30V AC.

Inside the heating element there is a temperature sensor element.

Fan:

Fan with changeable speed that can be operated varying the fan energy supply voltage.

Energy supply voltage: +12 Vdc (max).

Maximum power: 0.96 W.

Maximum air flow: 2.5 l/s.

Thermocouples:

4 thermocouples placed inside the oven, each one of them at a different height.

Temperature range:-184°C to 400°C.

Platinum resistance thermometer:

Platinum resistance temperature detector, suitable for measuring air and gas temperatures.

Temperature range: -70°C to 600°C.

Resistance (0°C): 100+/-0.1Ω.

Thermistor:

NTC thermistor for temperature measurement and control, with great sensitivity and stability.

Resistence at 25°C: 5.8 KΩ.

Temperature range: -40°C to 125°C.

Semiconductor temperature sensor:

Reverse polarized diode. The current through the diode depends on the temperature at which balance with the surrounding environment is achieved.

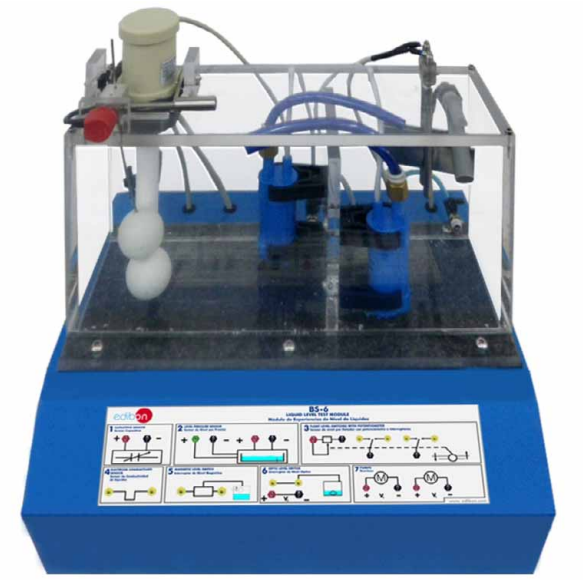
Therefore it needs a conditioning circuit able to transform this current variation in voltage proportional to temperature.

D-SUB to communicate with PLCE.

Connection pins.

Dimensions: 405 x 300 x 470 mm. approx. Weight: 10 Kg. approx.

PLCE-BS6. **Liquid Level Test Module**



Specifications:

Painted steel box.

Connection diagrams for each transducer are represented graphically.

Real industrial elements.

Water tanks.

Capacitative level sensor:

- Level sensor immersed in the tank.
- Power supply: 24 Vdc (max).
- Output: 11-20mAdc.

Pressure level sensor.

- It is a differential pressure sensor that measures the pressure practiced by the water compared to the atmospheric pressure.
- Pressure range: 0-1psi.
- Sensibility: 16.7mV/psi.
- Excitation Voltage: 10-16 Vdc.

Level gauge changeable resistance with path end and beginning switches:

- It is a resistance fixed to a float arm that will vary its position compared to the water level. This system complements itself with two end and beginning path switches respectively.
- Nominal value: 250V-10A.
- Switching current of the path end and beginning switches: 5 A/220Vac.

Conduction sensor:

- This sensor works with two electrodes immersed in one of the tanks. As the water level rises and covers the electrodes its resistance will decrease until it arrives to KΩ unit values, as long as the water does not touch the electrodes, the resistance between them will be very big and will behave like an open circuit.

Magnetic float level sensor:

- Sensor formed by a small float that has inside a magnetic element, the float base has a Hall effect element that detects when the float has gone up due to the effect of the water.
- Switching voltage: 240Vac, 110Vac.
- Max. switching current: 0.6Amp.

Optical level sensor:

- It is a photodiode and phototransistor, which in presence of water changes its refraction properties and make the output state approximately change from 3Vdc to 0Vdc.
- Power supply: 5Vdc.
- Load current: 20mA max. at 125°C.

2 Minipumps:

- The volume supplied by these pumps can be regulated varying the dc voltage value with which they are supplied.
- Power supply: 12Vdc (max. Voltage).
- Nominal volume: 1 l/minute.
- Nominal current: 1 A DC.

D-SUB to communicate with PLCE.

Connection pins.

Dimensions: 400 x 300 x 400 mm. approx. Weight: 10 Kg. approx.

PLCE-BS7. **Tachometers Test Module**

Specifications:

Painted steel box.

Connection diagrams for each transducer are represented graphically.

Real industrial elements.

Inductive Sensor:

- Output voltage: up to 10 Vpp.
- Body-housing material: Steel.
- Operating temp. range: -40°C to +60°C.

DC Motor:

- Nominal voltage: 12V.
- Resistance: 9,7 Oh.
- Max. vacuum speed: 8500 r.p.m.
- Max. load speed: approx. 3500 r.p.m.
- Start voltage: 210mV.

DC Tachometer:

- Voltage rating: 1.5V(dc).
- Power rating: 1.21W.

Refractive Infrared Sensor:

- Sensor where an infrared emitting diode and an NPN silicon phototransistor encased side-by-side on coverging optical axes in a black thermoplastic housing.
- Vo in output bornes of the module: 0.0-400mV for Vs=12VDC.

Slot Sensor:

- Slotted optical switch where an input LED and an output phototransistor are capsulated.
- Vo in output bornes of the module: 0.0-5V for Vs=5VDC.

Hall Effect:

- Hall-effect position sensor where exist a relationship between supply voltage and the combined effects of a change in sensitivity (gain) and null voltage output at room temperature.
- Supply Voltage: 4 to 10V.
- Supply Current: 3.5mA.
- Output type: Differential.
- Output voltage: 0 to 0.25V at 5V, 0 gauss.
- Sensitivity: (-400 to +400 gauss); 0.75 to 1.06 mV/gauss.
- Vo in output bornes of the module: 0.0-1V for Vs=5VDC.

Encoder:

- This optical encoder contains a lensed LED source, an integrated circuit with detectors and output circuit, and a codewheel which rotates between the emitter and the detector IC.
- Operating temperature: -40 to 100°C.
- Supply voltage: -0.5 to 7 V.
- Output voltage: -0.5 to Vdc.
- Output current per channnel voltage: -1 to 5 mA.
- Vibration: 20 g, 5 to 1000 Hz.
- Velocity: 30000 r.p.m.

D-SUB to communicate with PLCE.

Connection pins.

Dimensions: 300 x 200 x 200 mm. approx. Weight: 10 Kg. approx.

PLCE-BS8. **Proximity Test Module**

Specifications:

Painted steel box.

Connection diagrams for each transducer are represented graphically.

Real industrial elements.

DC Motor:

- Nominal power supply: 12Vdc.

Proximity capacitative sensor:

- It can detect metallic objects.
- Detection distance: 10 mm.
- Output: 10-60V Imax = 200mA.
- Power supply voltage: 10-60V.

Hall effect sensor:

- Proximity switch using the Hall effect, switching when there is a magnetic field.
- Power supply voltage: 5Vdc.
- Magnetic flux density: works at 22mT (35mT max), output voltage: low: 85mV., high: Vdc.

Infrared sensor by reflection:

- Emission narrow beam GaAs IR Emitter. Detection narrow beam IR Photodetector.
- Emitter: VF(max): 1.7, VR (min): 3V., radiation power: 4.8mW, peak wavelength: 935nm.
- Receiver: Vc (max): 12Vdc., Ic (min): 8mA., Darkness current: 100nA.

Transmission infrared sensor:

- Emission narrow beam GaAs IR Emitter. Detection narrow beam IR Photodetector.
- Emitter: VF (max): 1.7, VR (min): 3V., radiation power: 4.8mW., peak wavelength: 935nm.
- Receiver: Vc (max): 30V., Ic (min): 8mA., Darkness current: 100nA.

Conduction sensor:

- Proximity sensor with plate sensible to magnetic fields. Contact material: Rhode.
- Output: NO-NC.
- Breaking voltage: 400V.
- DC or AC current (max) 0.6Amp.

Inductive sensor:

- Sensor that gives variations in the output voltage as a variation of the magnetic field, caused by the near ferromagnetic material movement.
- Inductance: 12mH.
- Winding Resistance: 130 Oh.
- Detection distance: 2mm.

Ultrasound sensor:

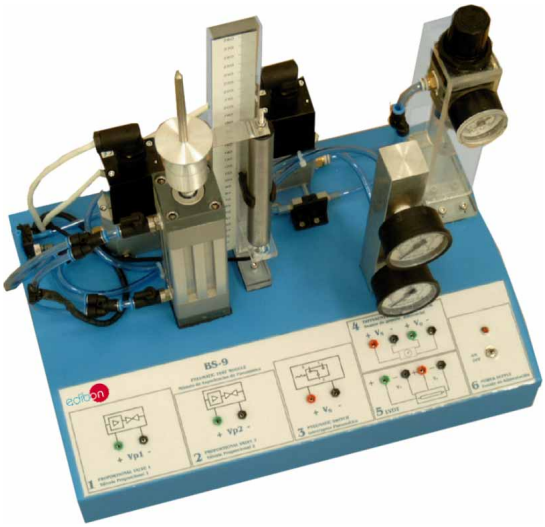
- Transmitter sensibility: 106 dB.
- Receiver sensibility: -65 dB.
- Resonance frequency: 40kHz.
- Operation distance: 40 cm.
- Output voltage: 20V rms.

D-SUB to communicate with PLCE.

Connection pins.

Dimensions: 400 x 270 x 200 mm. approx. Weight: 10 Kg. approx.

PLCE-BS9. **Pneumatic Test Module**



Specifications:

Painted steel box.
Connection diagrams for each transducer are represented graphically.
Real industrial elements.
Proportional valve 1 and 2:
- Nominal voltage: 24Vdc.
- Pressure range: 8 bar maximum, 0 to 6 bar control.
- Linearity: 1% full scale.

Differential pressure sensor:
- Measurement range: 0 to 30 psi.
- Sensitivity: 3.33mV/psi.
- Power supply range: 10 to 16 Vdc.

Pneumatic switch:
- Activation: 20 to 24Vdc.
- Positions: 2.
- Maximum pressure: 6 bars.

LVDT Sensor:
- Power-supply voltage: 9 to 24Vdc.
- Sensitivity: 60mV/mm/10Vdc.

Regulation filter:
- Manual drainage.
- Maximum input pressure: 8 bars.
- Flux: 14.5 dm^3/s.

D-SUB to communicate with PLCE.
Connection pins.
Dimensions: 300 x 300 x 300 mm. approx. Weight: 10 Kg. approx.

PLCE-BS10. **Light Test Module**

Specifications:

Painted steel box.
Connection diagrams for each transducer are represented graphically.
Photodiode:
- This sensor converts light into either current or voltage, depending upon the mode of operation.

Phototransistor:
- It also consists of a photodiode with internal gain.

Light Dependent Resistor:
- A LDR is a resistor whose resistance decreases with increasing incident light intensity.

Photovoltaic Cell:
- A photovoltaic cell converts solar radiation into direct current electricity.

Infrared emitter-receiver:
- This element consists of a IR emitter LED and IR phototransistor.

D-SUB to communicate with PLCE.
Connection pins.
Dimensions: 405 x 300 x 350 mm. approx. Weight: 10 Kg. approx.

✱Specifications subject to change without previous notice, due to the convenience of improvements of the product.

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